POLARIS PERSONNEL RESEARCH

DEVELOPMENT OF A FAULT INSERTION GUIDE AND INVESTIGATION OF REFRESHER TRAINING METHODS

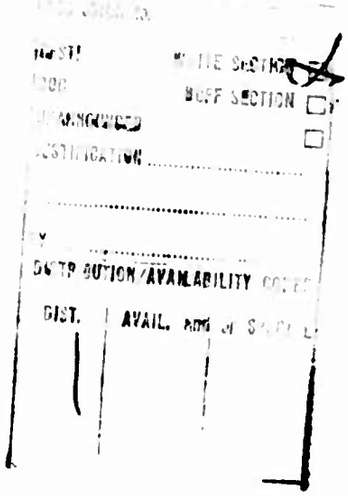
MAY 1966

REPORT NO. PRM 66-3

NEW DEVELOPMENTS RESEARCH BRANCH
PERSONNEL RESEARCH DIVISION
BUREAU OF NAVAL PERSONNEL

Although personnel research memoranda in the area of new weapons and support systems contain the best available preliminary information, some revisions may be required as the technical development of the systems progresses.

The conclusions and recommendations advanced are for information purposes. Policy considerations, as well as planning factors are applied prior to implementation. Therefore, these are not to be considered official policy or to indicate final courses of action by the Chief of Naval Personnel.



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DEVELOPMENT OF A FAULT INSERTION GUIDE AND INVESTIGATION OF REFRESHER TRAINING METHODS

May 1966

Report No. PRM 66-3

Prepared Under
Contract Nonr 5001(00)

for

New Developments Research Branch
Personnel Research Division
Bureau of Naval Personnel

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This study would not have been possible without the cooperation of the staff of the Fleet Submarine Training Facility, Pearl Harbor, Hawaii. Personnel who assisted in this study are specifically mentioned in the Personnel Contacts list (Appendix C).

SUMMARY

This research program was performed for the Bureau of Naval Personnel under Contract NOnr 5001(00) by Control Data Corporation, Howard Research Division.

The objectives of the program were: (1) to provide a Fault Insertion Guide to document the effects of inserting approximately seventy switching faults into the SSB(N) 627 Class Weapons Control Subsystem installed at the FLESUBTRAFAC, Pearl Harbor, Hawaii; and (2) to determine methods which would provide the most effective employment of the Weapons Control Subsystem for Operational Team Training.

The first objective was pursued by activating fault switches in the Simulator Room at various time periods beginning with Cruise Status and continuing through the receipt of a "Missile-Away" indication. The effects of these faults, and the period during which they were inserted, were observed at the Supervisor's Control Console (SCC), Launch Control (LCP), Integrated Monitor Panel (IMP), and the MTRE Mk 6. The equipment displays were recorded for each fault. Whenever the time of fault insertion would influence equipment displays, each set of displays was recorded for those specific times. The methodology of developing the Fault Insertion Guide is described in Section I of this report.

Section II of this report satisfies the second objective by outlining a suggested method of employing the Fault Insertion Guide to obtain maximum effectiveness from operational team training.

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TABLES

Section I

TRAINING DOCUMENTATION

A. Background

Team training philosophy at FLESUBTRAFAC is based on the following propositions:

1. The purpose of the Polaris Weapon System is to launch, successfully, its missiles.

2. During a countdown, the Weapons Control Subsystem (WCSS) crew should view any malfunction or fault that arises from the standpoint of: (a) determining if the fault is missilized or channelized; (b) ascertaining if the missile is capable of being fired by an operator's action; (c) if missilized troubleshooting is required, can it be accomplished in time to launch the missile or missiles; and (d) if channelized faults occur, inhibit the channel, casualty switch the remaining missiles, and begin troubleshooting the fault.

The above represents a logical process which increases the probability of attaining the prime objective of successfully launching 16 missiles.

B. Implementation

Efficient training of crews demands that facility instructors conduct team training in an orderly manner and be fully knowledgeable of all aspects of situations which are created by the use of inserted faults. The attainment of these objectives requires proper equipment setups in the Missile Control Center, Missile Compartment, and Simulator Room, and coordination of the instructors during a team training countdown.

C. Fault Insertion Guide

The Fault Insertion Guide developed under this contract contains a listing of equipment displays (observed indications) which appear at discrete periods during a launch sequence as a result of activating fault switches on the Missile, Launcher, Monitored Functions, Navigation, Missile Compartment, and Missile Control Center Simulators. For each fault, the equipment displays were verified on the Missile Control Center (MCC) and Missile Compart (MC) equipments at FLESUBTRAFAC. Additionally, the single-function diagrams were checked to ensure that they and the indications observed were in agreement.

The study went a step further and checked tactical documentation to ensure that the observed indications were consistent with those which would be seen on the tactical equipment as a result of the occurrence of faults corresponding to the simulated faults; whenever discrepancies were observed they were recorded in the "Remarks" column of the Fault Insertion Guide.

The Fault Insertion Guide provides MC and MCC instructors with the following information which is required for operational team training:

1. Time of fault occurrence

2. Resulting equipment displays

3. Suggested operator action

4. A description of the tactical casualty simulated by the switching fault.

5. Suggested troubleshooting techniques

6. Remarks section which covers any unusual conditions resulting from activation of the particular fault switch.

D. Fault Insertion Guide Format

The Fault Insertion Guide is organized into seven columns of information which describe each simulated fault. The following

paragraphs briefly describe the information contained in each column.

FAULT - This column contains an illustration and the title of each fault switch and the position in which the switch is placed to insert the fault.

TIME OF FAULT OCCURRENCE - Describes the time of fault insertion with respect to equipment status or states of readiness. These states are as follows: Cruise, Spinup, Transition (erection and alignment), 1SQ, Denoted, Assigned, Prepare, and Missile Away. The above "times" are referenced to events occurring in either the MC or MCC. The times specified for fault insertion have a direct bearing on both the resulting equipment displays and the operator's action. For example, 'the use of the Cqo' fault during "assigned" results in a different set of observed indications obtained as a result of the same fault occurring during the "time" of "1SQ". The suggested operator action and casualty isolation techniques are different in both cases.

OBSERVED INDICATIONS - This column lists equipment displays resulting from fault insertions. The equipments covered are the LCP, IMP, SCC, and MTRE Mk 6.

OPERATOR ACTION - After recognizing fault indications the operator should take action to either continue the countdown or report to the Weapons Officer the reasons for being unable to sustain the countdown. The "Operator Action" column lists steps the operator may take to circumvent interruption of the countdown. For example, a fine alignment fault occurring during channel operation could be either a missilized or a channelized fault. Rather than inhibit a channel until the missile guidance system is checked by the Integrated Test Operating Panel (ITOP), the SCC operator should try another missile in channel on the hypothesis that a missilized problem exists. If his hypothesis proves correct, he will be able to maintain his firing time since both channels will be available.

FAULT DESCRIPTION - This column contains a description of the tactical casualty simulated by the inserted faults. These descriptions clarify the actual mechanization of each fault; for

example, the differences between a "Tube Pressure" fault and a "Tube Overpressurized" fault are detailed.

CASUALTY ISOLATION - This column contains information regarding troubleshooting techniques. The difference between the "Operator Action" and "Casualty Isolation" columns lie in the fact that operator actions are based on an attempt to either (1) fire the faulted missile; (2) reset the missile to the end of the firing order; or (3) casualty switch fire control equipments. The SCC operator's sole objective is to fire as many missiles as possible. The casualty isolation procedures are a series of steps that can be taken by equipment or station operations to locate and repair faults without interrupt the tactical countdown. Many times a casualty isolation procedure cannot be carried out during a coundown; for example, an apparent hydraulic battery failure cannot be checked on the MTRE Mk 7 until the end of the countdown[1]. In such cases troubleshooting must be deferred until all available missiles are fired. This column is not all inclusive but attempts to provide the instructor with sufficient casualty isolation techniques to satisfy any questions from students.

REMARKS - This column provides instructors with a fuller understanding of each fault; for example, information is provided regarding fault switches which do not provide true simulations of tactical casualties or fault switches which will simulate tactical casualties only if activated at a prescribed time and under special conditions.

E. Summary

The Fault Insertion Guide provides the necessary data on applicable SSB(N) 627 WCSS simulated faults to enable launcher and fire control instructors to: (1) provide students with the correct equipment casualty displays; (2) recommend proper operator corrective actions; (3) draw comparisons between training faults and tactical casualty conditions; (4) immediately and confidently pinpoint the causes of faults which students are unable to locate; and (5) satisfactorily answer student questions regarding inserted faults (see Appendix B for samples).

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[1]In the present SSB(N) 627 Class WCSS configuration

F. Problem Cards

The purpose of the problem cards, Appendix A, is to ensure proper equipment setup prior to initiation of refresher team training and to ensure coordination of the MCC, MC, and Simulator Room instructors with respect to: (a) time of fault insertion; (b) designation of faulted missiles; (c) missle-to-fire order patching; and (d) mode of system operation.

The MCC, MC, and Simulator Room Problem Cards are grouped into sets, depending upon whether the Mk 84 F/C and Mk 21 Mod 1 Launcher Systems are being used in System Mode or Unit Lab Mode. In the System Mode a single problem requires three related cards: one for the MCC, one for the MC, and one for the Simulator Room.

Problems are set up by the MCC or MC instructors who select faults from the Fault Insertion Guide and fill in the laminated cards with a grease pencil. The cards are then distributed to the MCC, MC, and Simulator Room instructors according to the mode of operation selected.

G. Fault Classification and Verification

Contract Nonr 5001 (00) stated in part: "the contractor shall examine the effects of approximately 70 faults. . .at FLESUBTRAFAC, Pearl Harbor". These 70 faults included all faults capable of being inserted from the Simulator Room. One of the objectives of this contract was to differentiate between faults applicable to the SSB(N) 627 Trainer and those applicable to other systems--e.g., SSB(N) 616 Trainers (Dam Neck and Charleston). Table 1 of this section lists all faults not applicable to the FLESUBTRAFAC SSB(N) 627 Trainer. Table 2 lists those faults which are of little or no value when used for operational team training exercises.

In general, all faults were examined and classified as follows: (1) faults which provided useful training; or (2) faults which provided no useful training. Those faults classified as being useful were documented in the Fault Insertion Guide; the latter class of faults is listed in table 2 of this report. The classifications were developed on the basis of an implicit contract requirement which states: "this report shall specify how the tactical equipment and simulators can best be used for refresher team training FLESUBTRAFAC".

The basis for classifying the faults was: "Can this fault provide crews with realistic operator or casualty training?" For example, the Air Sampler fault which simulates the detection of radioactive contamination in the Missile Compartment - this fault could provide safety training providing FLESUBTRAFAC had the proper training materials available; however, this is not the case. Specifically, this fault does not provide either operator training or casualty training. Its use would limit the action of the IMP operator to merely signal the MCC and clear the compartment.

Similar arguments can be made for all the faults listed in table 2.

TABLE 1. FAULTS NOT APPLICABLE
TO PEARL HARBOR SSB(N) 627 TRAINER

Simulator	Fault	Remarks
LAUNCHER		
Common Section	Breather Valve	Non-applicable to Mk 21 Mod 1. Applicable to Mk 17 Mod 0.
Tube Section	Eject Valve	Non-applicable to Mk 21 Mod 1. Applicable to Mk 17 Mod 0.
MISSILE		
A-2 Panel	All faults on panel	Non-applicable to A-3 missile.
A-3 Operational Circuits	-29.5v external position	-29.5v is never checked in external position.
	+31.5v external position	+31.5v is never checked in external position.
A-3 Platform Section	CTA	Cable untwist is not applicable to the A-3 guidance system.
MONITORED FUNCTIONS		
Unit Lab Section	N_2 Supply Header	Use switch on Launcher Simulator.

Table 1. Faults Not Applicable to Pearl Harbor SSB(N) 627 Trainer (continued)

Simulator	Fault	Remarks
	Breather Valve	Non-applicable to Mk 21 Mod 1. Applicable to Mk 17 Mod 0.
	Guidance Water Temperature	This fault is not wired into system at present.
Missile Tube Section	Manual safety switch	Non-applicable to Mk 21 Mod 1. Applicable to Mk 17 Mod 0.
	Igniters	Non-applicable to Mk 21 Mod 1. Applicable to Mk 17 Mod 0.
	Aiming and firing	Non-applicable to Mk 21 Mod 1. Applicable to Mk 21 Mod 0.
	Motor internal pressure	Non-applicable to Mk 21 Mod 1. Applicable to Mk 21 Mod 0.

TABLE 2. FAULTS PROVIDING
LITTLE OR NO TRAINING CAPABILITY

Simulator	Fault	Remarks
MONITO ED FUNCTIONS		
Unit Lab Section	Heaters	This fault simulates the loss of missile tube heating capability.
	Water Pump	This fault simulates the malfunction of the missile tube cooling system water pumps.
	Air Sampler	This fault is used to simulate the presence of radioactivity.
	Air Supply Header	This fault simulates a low pressure in the air supply header.
	Compensation Header	This fault simulates a low pressure condition in the supply header which feeds the tube compensation system.
	Temperature Valve Control	This fault simulates the loss of control air to the temperature regulating valves.
	MC Hydraulic	This fault simulates the loss of missile compartment hydraulic pressure.

Section II

INVESTIGATION OF REFRESHER TRAINING METHODOLOGY

A. Background

Contract Nonr 5001(00) requires: "This report will specify how the tactical equipment and simulators can best be used for refresher training at FLESUBTRAFAC." To meet this requirement, various methods of refresher training were attempted and the most successful methods were chosen by a process of trial and error.

B. Refresher Training

Refresher Training is divided into two basic classifications:

1. Operational team training

2. Maintenance training

Operational team training consists of operating the MC and MCC Labs in a System Mode and requiring the crew in training to perform a series of Operational Team Training Countdowns. An Operational Team Training Countdown is simply a simulated tactical countdown. The main objective of the Operational Team Training Countdown is to fire 16 missiles.

Maintenance training requires that the MCC and MC each operate in Unit Mode; that is, the two labs are electrically isolated from each other. The simulators provide the functions normally obtained from the electrically isolated lab. The objective of maintenance training is to provide ship crews with an opportunity to isolate and repair the faults as they appear in the equipment.

C. Operational Team Training

Operational team training, as conducted at FLESUBTRAFAC, consists of providing submarine crews with the opportunity to:

1. Perform simulated tactical countdowns

2. Observe faults which might reasonably occur in a tactical launch

3. Perform certain operator actions in an attempt to launch as many missiles as possible under casualty conditions

4. Troubleshoot faults to a degree that does not impede or interrupt the countdown.

D. Research

Research to determine maximum equipment utilization was of the empirical form. Different ideas were tried until an acceptable method of training was devised. This research resulted in the following conclusions:

1. During a team training countdown, visual as well as audible co-ordination of the MCC/MC instructors and Simulator Room operators is necessary.

2. A team training countdown is considered a "Problem." Differences in the Problems given to crews in training is a function of the "faults" selected for insertion during the countdown.

3. The optimum number of inserted faults during one Problem is four.

4. Equipment and simulator set-ups prior to the start of a Problem, must be correct and co-ordinated. The slightest confusion among instructors results in almost total loss of a Problem's training effectiveness.

5. The optimum number of Problems presented during a morning session of a 3-to-4 hour duration is 4 to 6.

6. Troubleshooting is permitted during a Problem only if it does not interfere with the countdown.

7. Troubleshooting is allowed during the 15-minute period between Problems only: if it does not interfere with the instructor's set-up of the equipment for the next Problem; or, if it does not provide the crew with information as to the types of faults to be employed on succeeding countdowns.

8. The switching faults in the Simulator Room do not provide crews with certain types of operator training such as: Digital Geoballistic Computer (DGBC) coarse-bearing-servo-casualty switching, Digital Control Computer (DCC) casualty switching, Missile Motion Computer (MMC) casualty switching, MCC missile group, and channelized equipment casualty switching. This training deficiency will be corrected by the use of Faulted Modules.

E. Methodology

When Operational Team Training is in process, the MCC instructor acts as the lead instructor. The MCC, MC, and Simulator Room are electrically connected and operating in a System Mode. The MCC instructor decides which Problem is to be run and informs the Simulator Room and MC. The Simulator Room and MC instructors consult the System Mode Problem Cards and set up their respective equipments according to the instructions on the cards.

During the countdown, instructors may use the Problem Cards to grade the crew's performance in handling the casualty condition as the indications appear on the respective equipments. At the end of the countdown the MC and MCC instructors critique the Problem with their respective students.

F. Maintenance Training

Maintenance training is conducted with the MCC and MC operating in Unit Mode. The objective of maintenance training is to provide crews with the opportunity to localize faults and then to take corrective action. As in Operational Team Training, the Fault Insertion Guide provides the instructor with an

available reference source. The Problem Cards serve to coordinate MCC/Simulator Room and MC/Simulator Room equipment setups and provide fault insertion information. When fault indications appear the countdown may be interrupted to allow the crews to correct the casualty condition. Since the MC and MCC Labs are isolated from one another, each Lab may proceed at the rate set by the respective operating crews.

Section III

CONCLUSIONS AND RECOMMENDATIONS

The objectives of this study have been attained by the compilation of a Fault Insertion Guide, by verification and classification of the faults available to the WCSS, by development of a Problem Card Format, and by performing a critical analysis of training techniques.

The Fault Insertion Guide documents the WCSS Simulator Room in its present configuration. However, as Special Project Alterations (SPALTS) are added to the system and other system changes take place, the Fault Insertion Guide could become obsolete. Therefore, it is recommended that the Fault Insertion Guide be incorporated into the facility manual, OP 3294, to provide for periodic updating.

The training capability will be vastly improved and enlarged by the Special Projects Office Faulted Module Program, which is underway. This program allows actual faulted modules to be inserted into the Mk 84 Fire Control System, which provides the crews in training with valuable troubleshooting and operator experience by providing an enlarged number of realistic simulated tactical casualty conditions. The official publication documenting the Faulted Module Program is HRC Handbook 103. It is further recommended that the Fault Insertion Guide be enlarged to cover the additional simulated tactical casualty conditions provided by the Faulted Module Program.

Appendix A

PROBLEM CARDS

MISSILE CONTROL CENTER

PROBLEM NO. _____

EQUIPMENT REQUIREMENTS

1. Power Input Panel — on ☐ off ☐

2. Control Console
   Equipment Mode _____
   Missiles 1 SQ — yes ☐ no ☐
   Missile #9 used — yes ☐ no ☐

3. DGBC
   Normal ☐
   No Targets ☐
   No Program ☐

4. Trolley Used — yes ☐ no ☐

5. Sound Powered Phone Req. _____

6. Test Equipment Req. _____

7. Prefaulted Module Faults

EQUIPMENT CHECK LIST

POWER INPUT PANEL NORMAL	☐
CONTROL CONSOLE NORMAL	☐
MISSILE TO FIRE ORDER COMPLETED	☐
MISSILE BYPASSED OR 1SQ AS REQ.	☐
PRINTERS HAVE PAPER	☐
DGBC NORMAL AND READY FOR PROBLEM	☐
DGBC TAPES AVAILABLE	☐
MTRE MK6 NORMAL	☐
BATTERY TIMERS RESET	☐
FC SWITCHBOARD NORMAL	☐
TEST EQUIPMENT READY	☐

PRE-FAULTED MODULES

MODULE REQ.	LOCATION

PREFAULTED MODULES INSERTED	☐
TROLLEY READY IF USED	☐
MCC READY	☐
SIMULATOR ROOM READY	☐
ULCER READY IF USED	☐
MISSILE COMPARTMENT READY	☐
ALL STAFF STATIONS READY	☐
ALL STUDENT STATIONS READY	☐
START PROBLEM	

MISSILE CONTROL CENTER

PROBLEM NO. _____ SHIP _____

LAB MODE SW. _____ DATE _____

EQUIPMENT MODE _____ TIME COMMENCE _____

FAULT NOS. _____, _____, _____, _____, _____

MISSILE TO FIRE ORDER

FIRE ORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MISSILE																

FAULT NUMBER	MSL	F/O	CHAN	TIME OF INSERT.	FAULT INDICAT.	ACTION TAKEN	REMARKS

NOTES:

MISSILE COMPARTMENT

PROBLEM NO. _____

EQUIPMENT REQUIREMENTS

LAB MODE SWITCHING _____

TROLLEY LAB MODE SW. _____

MISSILE #9, USED YES ☐ NO ☐

TUBE #9, USED YES ☐ NO ☐

	1SQ	NOT 1 SQ
LAUNCHER PANELS (MC UNIT ONLY)	☐	☐

	REMOTE	LOCAL
MK 84 SIM	☐	☐

	TACTICAL	DUMMY
FC MODE	☐	☐

PREFAULTED MODULE FAULTS USED

LAUNCHER _____, _____,

_____, _____, _____,

MK 133 _____, _____,

_____, _____, _____.

TROLLEY _____, _____,

_____, _____, _____.

TEST EQUIPMENT REQUIRED.

_____

_____

SOUND POWERED TELEPHONE REQ. _____

EQUIPMENT CHECK LIST

MISSILE #9 USED TUBE #9 USED

LOWER LEVEL

- MT GTU NORMAL ☐
- TM HYD POWER ON ☐
  - AIR PRESSURE AVAIL ☐
  - COMPRESSOR AUTO ☐
  - HYD MANIFOLD LINED UP ☐
  - AIR MANIFOLD LINED UP ☐

MIDDLE LEVEL

- MT HPTP ON ☐
  - MPTP ON ☐
- MT IMP RECTIFIER ON ☐
  - POWER TO LCP & IMP ☐
  - SEA HEAD SIMULATOR ON ☐
  - HUMIDITY MONITOR ON ☐
  - SONO SWITCH CONT ON. ☐
  - LAUNCHER PANELS NORMAL ☐
  - EBW SIMULATOR ON ☐

UPPER LEVEL

- MT WATER COOLER NORMAL ☐
  - MK 133 NORMAL ☐
- TM LOCKING RING ☐
  - ACTUATORS CLEAR ☐
  - INTERLOCK RODS A-B CON. ☐
  - HATCH OPERATE PISTON ☐
  - BREATHER VALVE 100/101 AUTO ☐
  - SYSTEM ALIGNED FOR PROPER OPERATION ☐
  - HATCH CLEAR FOR OPER. ☐
  - SAFETY CHAINS INSTALLED ☐

OTHER MT 31.5 V RECTIFIER ON

MISSILE & TUBE #9 NOT USED

- TM LCP NORMAL ☐

REPORT TO M.C.C. WHEN READY

MISSILE COMPARTMENT

PROBLEM NO. _____ SHIP _____

LAB MODE SW. _____ DATE _____

EQUIPMENT MODE _____ TIME COMMENCE _____

FAULT NOS. _____, _____, _____, _____, _____

MISSILE TO FIRE ORDER

FIRE ORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MISSILE																

FAULT NUMBER	MSL	F/O	CHAN	TIME OF INSERT.	FAULT INDICAT.	ACTION TAKEN	REMARKS

NOTES:

SIMULATOR ROOM

PROBLEM NO. _____

EQUIPMENT REQUIREMENTS

LAB MODE SW _____ ULCER LAB MODE SW _____ TROLLEY MODE SW _____

(MCC UNIT-SYSTEM ONLY) (MC UNIT ONLY)

NAVIGATION SIMULATOR

SINS SELECT _____

SHIPS MOTIONS
- DYNAMIC ☐ ZERO SET ☐
- STATIC ☐ OTHER _____
- UHO FT/SEC _____ EIO DEG _____
- UVO FT/SEC _____ ZO DEG _____
- LXO _____ CQO _____
- LYO _____

MC SIMULATOR

TUBE CONTENTS
- TACTICAL ☐ DUMMY ☐

LAUNCH MODE
- SURFACE ☐ SUBMERGED ☐

LAUNCH GATE _____

TROLLEY UNIT MODE
- MCC ☐ LOCAL ☐

BDAIM 10 SEC ☐ 30 MIN ☐

MK 84 SIMULATOR

MK 84 SIM
- REMOTE ☐
- LOCAL ☐

FC MODE
- TACTICAL ☐
- DUMMY ☐

(MC UNIT & SYSTEM

LAUNCHER SIMULATOR
- SAFE ☐ READY ☐

(ALL MODES)

SIMULATOR FAULTS USED

1. _____ 2. _____

3. _____ 4. _____

EQUIPMENT CHECK LIST

(SYSTEM MCC UNIT)

LAB MODE SWITCHING COMPLETE	☐
ALL FAULT SWITCHES NORMAL	☐
BATTERYS RESET	☐
TRAMP STATUS REMOTE	☐
RELOAD ALL TUBES	☐
MC SIMULATOR NORMAL	☐
TUBE CONTENTS	☐
SHIPS MOTIONS NORMAL	☐
MONITORED FUNCTION SIM. NORMAL	☐
LAUNCHER SIMULATOR NORMAL	☐
ALL PRESET FAULTS INSERTED	☐

REPORT TO M.C.C. WHEN READY

(MC UNIT ONLY)

MK 84 SIMULATOR	☐
SIMULATOR EXIT. OFF	☐
SIMULATOR EXIT, ON	☐
SIMULATOR FC MODE	☐
MISSILE F/O SET	☐
ALL FAULTS NORMAL	☐
MONITORED FUNCTION	☐
SIMULATOR NORMAL	☐
LAUNCHER SIM. NORMAL	☐
ALL PRESET FAULTS	☐
REPORT TO M.C. WHEN READY	☐

SIMULATOR ROOM

PROBLEM NO. _____ SHIP _____

LAB MODE SW. _____ DATE _____

EQUIPMENT MODE _____ TIME COMMENCE _____

FAULT NOS. _____, _____, _____, _____, _____

MISSILE TO FIRE ORDER

FIRE ORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MISSILE																

FAULT NUMBER	MSL	F/O	CHAN	SIM	FAULT	TIME OF INSERT.	POST PROBLEM ACTION

NOTES:

Appendix B
FAULT INSERTION GUIDE SAMPLE

FAULT	TIME OF FAULT OCCURRENCE	OBSERVED INDICATIONS	SUGGESTED OPERATOR ACTION	FAULT DESCRIPTION	SUGGESTED CASUALTY ACTION	REMARKS
INITIATION CIRCUIT CHECK  Switch set to FAULT	MCC Prepare	SCC [ASSIGNED] MISSILE PREPARED - red ASSIGNED [HOLD] AUTO- yellow [ASSIGNED] RESET - blue Printouts - 2018 or 3018 missile prepare alarm. MTRE MK 6 Step 14 - INITIATION CIRCUIT CHECK - red	Request MTRE Mk 6 operator to determine malfunction. After malfunction is ascertained, depress blue [ASSIGNED] RESET until [HOLD] AUTO lights yellow. If alarm occurs on next missile in that channel, depress CHANNEL INHIBIT and note it lights yellow. If alarm recurs when the reset missile is again prepared, notify WCO and request instructions.	The fault simulates an inoperative ignition inverter.	1. Replace ignition inverter.	
OIL LEVEL  Switch set to Positions 1, 2, 3 or 4	MCC Denoted	SCC [DENOTED] ACTION COMPLETE - red [DENOTED] RESET - blue Printouts - 3022 or 2022 missile denoted alarm MTRE MK 6 Step 10 HYD FLUID QTY. NORM- red	Request Operator check MTRE Mk 6 to determine if casualty occurred. Depress [DENOTED] RESET until [HOLD] AUTO yellow. Note [DENOTED] ACTION COMPLETE and [DENOTED] RESET go out. If malfunction occurs on next missile assigned to this channel, depress CHANNEL INHIBIT, note that it lights yellow. If missile is again DENOTED and malfunction occurs notify WCO and request instructions.	The fault simulates a low oil level in package number switch is set to.	1. Check visual indicator on each hydraulic package. 2. Charge as necessary	If command decides to fire missile, it can be launched under the following conditions: a. Reset from channel; b. Override oil level on MTRE Mk 6; c. Hydraulic pressure normal.

APPENDIX C

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13. ABSTRACT

This research study discusses the methodology employed in developing the Fault Insertion Guide for the Fleet Submarine Training Facility, Pearl Harbor, Hawaii.

The purpose of the Fault Insertion Guide is to provide information concerning the insertion of faults into the system by opening circuits through switches in the Weapons Control Subsystem simulators. Also, the Guide is to be used as a reference for developing problem cards used by instructors to train crews in responding to casualty situations.

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	ROLE	WT	ROLE	WT	ROLE	WT
Fault Insertion Guide SSB(N) 627 Class Fleet Submarine Training Facility Pearl Harbor Training Documentation Weapons Control Subsystem						

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